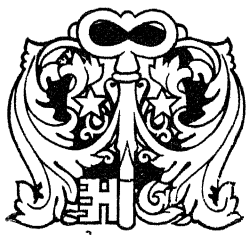
Ohio Agricultural Experiment Station

CIRCULAR No. 56
WOOSTER, OHIO, JUNE 1, 1906

A VISITORS' GUIDE

TO THE MORE IMPORTANT FEATURES OF THE STATION'S WORK IN 1906



THE EXPERIMENT STATION PRESS
WOOSTER, OHIO
1906

THE Ohio Agricultural Experiment Station was organized in 1882, under an act of the State Legislature, and was first located at the State University at Columbus. In 1892, under another act of the Legislature, it was transferred to its present site at Wooster, in Wayne County.

The Station is supported by state and national funds. It now owns 470 acres at Wooster and 300 acres at Carpenter, in Meigs County. It leases 185 acres at Strongsville, in Cuyahoga County, and 53 acres at Germantown, in Montgomery County. The scientific staff of the Station includes 19 men, and during the busy seasons of the year the assistance of from 40 to 50 other people is required on the central farm and sub-stations.

The Station's work is conducted under 9 administrative departments, each under supervision of a department chief, and dealing with the following subjects:

I, MAINTENANCE OF SOIL FERTILITY.

II, HORTICULTURE.

III, AGRONOMY, OR FIELD CROPS.

IV, PLANT PHYSIOLOGY AND PATHOLOGY.

V, CHEMISTRY.

VI, ENTOMOLOGY.

VII, FORESTRY.

VIII, ANIMAL HUSBANDRY.

IX, COOPERATIVE EXPERIMENTS.

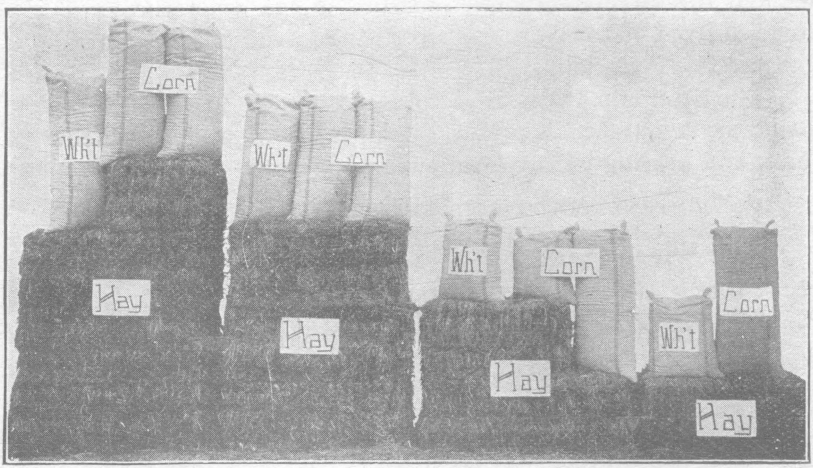
MAINTENANCE OF FERTILITY

DIRECTOR CHAS. E. THORNE, *Chief*

In the prosecution of this work, at the central station and three test-farms, there are used more than 1400 plots, most of which are one-tenth acre in size. These plots are usually divided into special crop rotation tests, in which there are as many equal-sized sections—varying from 20 to 40 plots each—as there are crops in that particular test. This is done in order that each crop may be grown each year with the different fertilizer treatments.

In all these tests, there will be found at each plot a stake showing the kind and amount of fertilizer that has been applied to it. It will be noticed that every third plot receives no fertilizer whatever, in order that every fertilized plot may have an unfertilized plot close at hand for purposes of comparison.

In the south 60 plots of Range VIII and in all of Range IX will be found a five-crop fertilizer test, started in 1894. In this test are grown corn, oats, wheat, clover and timothy, in the order named. During the last seven years the aver age increase on the best fertilized plots compared with the unfertilized plots, has been for corn, from 31 bushels, unfertilized, to 48 bushels, fertilized, per acre; for oats, from 32 to 55 bushels; for wheat, from 8 to 27 bushels; for clover, from 1850 to 3090 pounds, and for timothy, from 2345 to 3310 pounds.



Thirteen-year average yield from one ton of manure.

Fresh manure Acid phosphate	Fresh manure Floats	Fresh Manure Untreated	Yard manure Untreated

In the south-east corner of the Station farm will be found a three-crop test, which was started in 1894, and in which are grown potatoes, wheat and clover. In a part of this test, during the last seven years, the average increase in potatoes has been from 180 bushels, unfertilized, to 195 bushels, fertilized, per acre; in wheat, from 33½ to 42 bushels, and in clover, from 3400 to 4100 pounds.

In the manure test, just north of the feeding barn, which was started in 1897, and in which corn, wheat and clover are grown, the increases have been, for corn, from 37 bushels, unfertilized, to 62 bushels, fertilized, per acre; for wheat from 9 to 25 bushels and for clover from 1900 to 4400 pounds.

If we figure corn at 40 cents per bushel, oats at 30 cents, wheat at 80 cents, potatoes at 40 cents, hay at $8.00 per ton, stover at $3.00, straw at $2.00 and the fertilizers which were applied, at cost, the net increase has been more than $4.00 per acre per year, and in the case of the manure test the net increase for manure, which has been reinforced with phosphorus, and taken direct from the shed to the field, is more than $4.50 per ton of manure.

In 1905 there was started on Range VII a three-crop fertilizer test, in which corn, wheat and clover are grown, in order to make a special study of the use of lime and floats (untreated phosphate rock), on these crops.

At the north end of Range VIII may be found an interesting continuous cropping test, in which the evils of growing corn after corn, wheat after wheat, etc. are well portrayed. The wheat plots have become so thoroughly overrun with grass, in spite of careful cultivation, that it has seemed necessary to fallow half of each of them this season and the other half next season, in order to clean them.

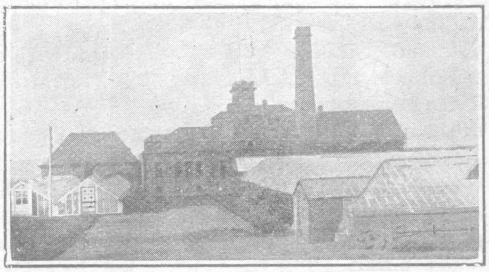
A detailed description of each of these and other tests, together with detailed tables of results, may be found in Bulletin 141* and Circulars 40, 54 and 57, the last of which is a summary of all.

HORTICULTURE

W. J. GREEN, *Horticulturist*

GREENHOUSE

The method of watering by sub-irrigation, which was originated at this Station in 1888, is still being tested in comparison with surface watering (See Bulletin 61).



The Station Greenhouses

The experiments with tomatoes are thick and thin planting, training to one and two stems, variety and soil tests. (See Bulletin 153).

With cucumbers the experiments are thick and thin planting and pruning.

Lettuce was under experiment earlier in the season, three successive crops being grown on the same soil.

*All bulletins and circulars mentioned in this guide may be procured at the mailing room in the main building.

As soon as the tomato and cucumber crops are gathered, an experiment will be started in soil treatment by mulching, the object being to incorporate plant food in the soil by this method, instead of removing the soil from the benches to be composted, as is usually practiced.

THE CAMPUS

There are 135 different species of trees growing on the campus, the object being to compare their rate of growth, to test their hardiness, to determine their value for ornamental planting and to modify the extreme effects of heat and cold. The first tree planting on the campus was done in 1895. There are also 280 species and varieties of shrubs and hardy perennials that have been planted at various times.

FRUITS AND VEGETABLES

At the Station orchards will be found 850 different varieties of tree fruits, 116 different varieties of grapes and 150 different varieties of small fruits.

The apple orchards are used for spraying experiments, mulching experiments and variety tests.

The old orchard near the barn is more than 35 years old. A system of renewal by heading in is under trial in this orchard. The trees, which were planted only 30 feet apart, had become so tall as to make spraying and gathering of the fruit very difficult. The practice gives promise of good results.

Taking advantage of the peach crop failure, some of the peach trees have been headed in also, in order to renew the tops and to get them into a more compact form.

The main part of the young orchard devoted to varieties was planted in 1893. It was cultivated seven years but, because of washing of the soil and difficulty of growing cover crops, it was manured in 1900 and seeded to grass. No fertilizer, other than this manure, has been used on it at any time. The grass has been cut and left on the ground and the trees mulched with straw every year since seeding.

West of the frame house is an apple orchard planted in 1900 for the purpose of a mulching experiment. Half of the trees were set in the grass which has been cut each year and left on the ground. The other half were set in plowed ground and have been under cultivation with cover crops. Half of the trees set in grass have been hoed about and the other half have been mulched with the grass cut between the trees. (See Bulletin 171). A mulching experiment with peach trees is located just south of the house.

A dwarf pear orchard south of the old apple orchard is devoted to a mulching test.

North of the frame house is an apple orchard of varieties, planted in 1905. The trees were set in a clover field and mulched.

East of the road, on the opposite side from the young apple orchard, just mentioned, is a peach orchard planted in 1905. The trees were set in sod and mulched.

With the exceptions above mentioned, all the fruit trees are in grass and are mulched each season, in some cases by cutting the grass that grows between the trees, leaving it on the ground, and in other cases by adding other material.

The main feature in the strawberry work, east of the barn, is a variety test, but spraying and cultural experiments are in progress. (See Bulletins 154 and 166).

West of the brick house are variety plots of currants, gooseberries, raspberries and blackberries.

East of the barn are variety plots of tomatoes and celery.

Between Range IX and the forestry work is a variety test of potatoes.

AGRONOMY

C. G. WILLIAMS, *Agronomist*

The work in field crops is being conducted at the central farm and at each of the sub-stations. Here at the central farms the following tests may be seen:

OATS

Upon plots 1-60, of Range I, are growing 39 varieties of oats, 3 varieties of spring barley, 2 varieties of spring wheat and emmer (frequently called spelt or speltz).

Following this, plots 61-69 are devoted to quality work, in which large oats, small oats (mainly secondary) and light oats (those blowing over when passed through a Chatham mill,) are compared. These three grades are selected from grain grown from similar grades last year.

On plots 70-74 is tested the value of clipping back as a preventive of lodging.

On plots 75-83 are tested different rates of seeding, ranging from 4 to 12 pecks per acre.

Plots 85-90 were seeded at different dates, beginning April 7th and ending May 12.

In Block M, in the oat field, between Ranges VIII and IX, are 9 plots upon which common salt is used at the rate of 200, 400 and 600 lbs. per acre, each alternate plot being drilled in without salt.

For oat breeding work, see page 9.

CORN

At the north end of Range II are 9 extra plots devoted to early and late planting of corn, the first plot having been planted April 16th and the others at intervals of 7 days on to May 21st.

The east end of plots 1-20 and all of plots 21-35 are devoted to variety testing.

On plots 36-58 are tested different strains and selections, mainly of Clarage corn.

A study of the effect of length and shape of ear, using three standard varieties, is being made on plots 59-70. Photographs of these different types of ears may be seen at the office.

In Block J, east of the horse barn, are ten plots of thick and thin seeding varying from 1 to 5 plants per hill.

In Block I, in same field, are 10 plots of Ensilage corn, Virginia, Red Cob and Leaming. Half of these plots have pole beans growing with the corn.

For corn breeding work, see page 9.

WHEAT

In Range IV, plots 1-90 are devoted to the testing of 58 varieties of wheat. Attention is called to plot 87, seeded Sept. 26, 1905, to Minnesota No. 169—a spring wheat—,to plot 89, seeded April 13, 1906, to the same variety and to plot 60, seeded April 13, 1906, to Valley wheat—a winter variety.

In the field across the Infirmary road and north of the feeding barn will be found the cultural wheat. Plots 1-8 are in early and late sowing, the seeding beginning Sept. 1st. and concluding Oct. 21st,—a plot having been sown each week,—the Mealy variety being used in each plot.

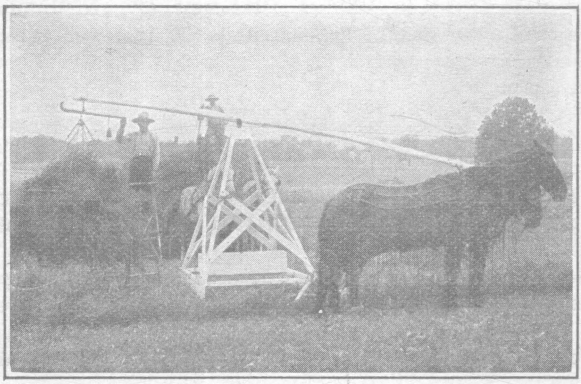
Plots 9-32 are in thick and thin seeding, ranging from 3 to 10 pecks per acre. Three different varieties—Poole, Gypsy and Early Ripe—are used in this work, thus giving three plots to each rate of seeding.

Plots 33-38 are in quality work, being a continuation of previous work with different grades of wheat, as separated by a fanning mill. (See Bulletin 165).

For wheat breeding work see page 9.

ALFALFA

At the north end of Range V, 39 tenth-acre plots were seeded with alfalfa in 1904. A comparison as between phosphorus alone; phosphorus and potassium; phosphorus, potassium and nitrogen; manure, and manure plus phosphorus, was made upon each block of 10 plots, the 4 blocks being treated alike in this particular. Plots 2-10 were seeded without liming or soil inoculation; plots 11-20 had 800 lbs. of lime per acre; plots 21-30 without lime, but with soil inoculation, plots 31-40 with 800 lbs. of lime and soil inoculation. This seeding of alfalfa was a total failure, save upon the limed plots, and here was only a partial success.



Weighing the hay in plot work

In 1905 all of these plots, except a front strip 25 feet wide, which is still standing, were plowed up and seeded again, the fertilizer and manure treatment being repeated in part. Previous to this reseeding lime was applied to all the blocks; plots 2-10 receiving 2500 lbs per acre; plots 11-20, 4200 lbs. per acre; plots 21-30, 2500 lbs. per acre; and plots 31-40, 2700 lbs. per acre, (Plots 11-20 and 31-40 having had 800 lbs. per acre in 1904.)

The 1905 seeding was divided into three unequal parts, crosswise of the plots. One half on the west side was seeded May 24th; one fourth, just east of this, July 6th and the other fourth on Aug. 3rd.

Other alfalfa work may be found across the infirmary road, about 90 rods north of the horse barn, where tenth-acre plots, fertilized and limed in different ways, are compared with the same number of sweet clover plots, fertilized and limed in the same manner, and all seeded Aug. 19, 1905.

North of the picnic grounds, in Block O, an early and late seeding test is in progress this year.

For alfalfa breeding work, see page 9.

PLANT BREEDING

Alfalfa. In Block F, west of the middle part of Range I, are nursery plots of 2000 plants, growing singly, one by two feet apart, and from seed gathered from 22 different states and countries. The more promising of these are being harvested individually and the total yield per plant, the proportion of leaf to stem, the yield of protein and fat, the rust resistance, the retention of leaves, the resistance to cold, etc., are being determined with the hope of securing foundation stocks for more hardy and more desirable strains for Ohio.

Corn. A duplicate ear-row test of 50 ears—121 rows including check rows—of Clarage corn is being made on Block J, east of the horse barn. A similar test of 50 ears of two promising strains may be found at the south end of Range II, the rows running crosswise of the plots.

There is also, at the south end of Range II, a test of the heredity of grains of corn from different parts of the ear. For this purpose, some of the ears under test are divided into five transverse sections, and some into five longitudinal sections.

In Block K, across the infirmary road north of the horse barn, is a breeding plot, in which remnants of the best yielding ears of a 1905 ear-row test are planted side by side. All plants are de-tasseled save those from one sire ear. Every other row throughout the plot is planted from this sire ear.

In Block L, northeast of the feeding barn and across the Infirmary road, is a high protein breeding plot, in which the highest protein ears of last year's high protein plot are crossed with a high protein ear taken from the 1905 field crop.

In Block P, north of the dairy barn, is a high protein breeding plot, in which similar high protein ears, from last year's high protein work, are crossed with a related high protein ear.

In Block G, south of Range VII, is a breeding plot, in which for comparison, selected ears, which were grown in the 1905 ear-row test plot, are crossed in the same manner as the original remnants of the dams of these ears are crossed in Block K.

For purposee of comparison, plants from the remnants of the lowest as well as the highest yielding ears of 1905 will be crossed by hand pollination upon a common dam. For similar purposes, vigorous barren plants and similarly bred productive plants will also be crossed upon a common dam.

Wheat. In Block H, east of Range VII, will be found the wheat breeding work consisting of 16,000 plants, grown 4x4 inches apart. This work includes plants grown from seed from plants which were selected in the field last season fo. earliness, freedom from rust and stiffness of straw; from plants similarly selected showing high protein as determined by chemical analysis, and also from bulk seed selected for high and low protein, by mechanical examination. It also includes a comparative test in small plots, about 100 plants each, of the yielding ability of grain grown on high yielding plants in last year's breeding work.

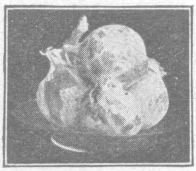
Oats. In Block N, west of Range IX, is a breeding test of oats which includes some 18,000 plants, grown as in the wheat breeding work and from similar selections, except that special emphasis has been laid on stiffness of straw.

Soybeans. In Block G, south of Range VII, is the nursery plot of soy beans, in which 10,000 plants of a number of promising strains are grown 2x2 feet apart. From these, individual plants will be selected, with reference to total yield, yield of protein, yield of fat, retention of grain, height of plant and of pods on the plant.

PLANT PHYSIOLOGY AND PATHOLOGY

AUGUSTINE D. SELBY, *Botanist, Plant Physiologist and Pathologist*

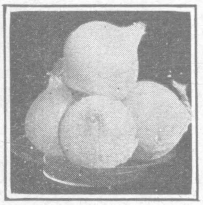
This Department's offices and laboratories are in the Administration building, second floor; its greenhouse (Pathologium) in the Biological building. The work of the Department pertains to plants in their technical relations, and is concerned with the identification of plants and seeds; the purity and viability (germination) of commercial seeds; the identification of diseased conditions in plants, including the parasitic plants causing disease, and the the prevention of plant diseases by spraying or otherwise. The Department has further been charged with certain work in plant breeding, including the crossing of varieties of wheat, corn, oats and tobacco, and the subsequent breeding out aud selection of these plant hybrids.



Continuous cropping

SEEDS, WEEDS, HERBARIUM

The *seed work* and *weeds*, as also the *herbarium* are to be studied best in the Laboratory, where the collections are fully accessible to any who may have special, definite features or objects to study. Here also are the books of reference upon these topics and upon *Systematic Botany*. Visitors seeking to have seeds, plants, etc., identified are urged to come directly to the laboratory and make known these wants.



Rotated

PLANT DISEASES AND SPECIMENS

These are also in ihe laboratory; those seeking advice as to the treatment of particular diseases or special crops are advised to come there for information.

The Department has certain plantings for *the study* of *particular diseases*; of these are experiments with diseased *peas* in the variety plots and the Pathologium or adjacent garden.

Cooperative experiments in many lines are being conducted at several points in the state. Among these are experiments in *spraying potatoes* for prevention of late blight; *spraying tomatoes* for leaf-spot; *treating tobacco plant beds* and *greenhouse soil* to destroy soil infesting fungi, notably in greenhouses where lettuce is grown, and other local or special studies.

PLANT BREEDING

The plant breeding work, cereal and tobacco hybrids, will be found, the former in the variety plots of the Station, the latter at the Germantown Test Farm. The wheat hybrids about 150 numbers, (75,000 plants) fourth year, are planted in small plots, 1-60 acre each and in Centgeners in the north end of Range IV are labeled.

The corn crosses, fourth year, are similarly, in Block F, west of Range I, in north end of Range II, and in the Test Farm plots at Strongsville, Germantown, and Carpenter.

The oat hybrids, second or mutation year, (45,000 plants) about 150 numbers, are in Centgener plantings only, in Block F.

CHEMISTRY

JOHN W. AMES, *Chemist*

The work of this Department is closely interwoven with that of almost every other department of the institution, although the larger amount of it is in conjunction with the Department of Maintenance of Fertility, Agronomy, Botany, and Cooperative Experiments.

It makes, on the average, not less than 800 separate determinations per month, which are confined largely to the mineral constituents of the soils, manures and plants, and to protein and fat determinations of the various grains and forage plants. Each of these determinations is a part of some carefully planned experiment, which is being carried on, either on some of the Station farms or by some of our cooperative experimenters.

The amount of work required to do this is so great that the facilities of our laborators are continually taxed to the utmost, so that we are forced to decline to make determinations at random for those of our friends who write in for such, much as we would like to do so.

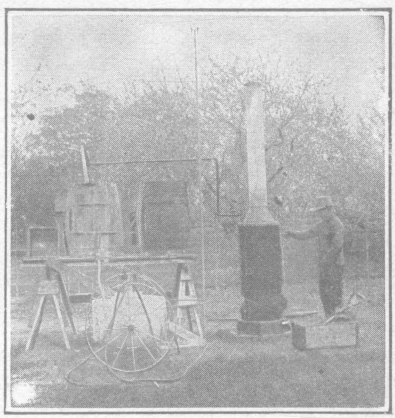
While the general visitor may not be especially interested in laboratory work of this character, probably all will be interested in some pot experiments conducted by the chemists in conjunction with the field work, which may be seen near the main building.

Likewise many will be interested in the exhibits in the main building, showing the chemical content of crops and the mineral constituents extracted from the soil by these crops in growing. Other exhibits, such as the effect on manure of leaching due to rains, are of great value.

ENTOMOLOGY

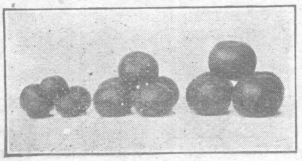
H. A. GOSSARD, *Entomologist*

Most of the field work of this department is necessarily done at a distance from the Station wherever conditions offer the best opportunities. At the Station is a representative collection of injurious insects and examples of their damage. The full life histories of some of the more important species, from egg to adult, are shown in special cases, known as Riker mounts. These exhibits are very attractive to most of our visitors. Persons who are interested in entomological methods can see various instruments, tools and appliances by which insects are captured, prepared and preserved.



A $15.00 cooperative spraying outfit

An important part of the work of the department is to give advice regarding injurious insects sent to the Station for



Unsprayed Sprayed

Identification. Parties who expect to visit us and are troubled by injurious insects are requested to bring with them specimens of the depredators causing them annoyance. We will cheerfully give them all the assistance possible.

FORESTRY

EDMUND SECREST, *Chief*

The greater part of the Station's work in forestry is done either at the test-farms or throughout the state at large in cooperation with the farmers. More than 400 acres of land have been set with transplanted seedlings and are under experiment in this manner. (See Circular 50). However, the following work will be found at the Wooster farms.

In the south part of the picnic grounds is a grove of ash trees, which have sprung up since the forest trees were cut in 1892.

East of the picnic grounds is a grove of catalpa, planted in 1901. These trees were purchased for *Catalpa speciosa*, but nearly all of them are spurious. Many of these trees were cut back at two years of age. This grove shows the results which may be secured with inferior trees if care is used. The use of such trees is not recommended, however.

Near the catalpas, on the south, is a small grove of osage orange, planted in 1901.

Still further south is a grove of catalpa, planted ir 1903. Part of these were trimmed and part were cut back to the ground.

Immediately south of the last mentioned grove is a grove of locust, planted in 1903. In this grove the Department of Entomology is testing various methods for protecting the trees against the locust body borers.

South of the locust grove is a grove of ash, the trees of which are the same age as the largest catalpa trees, but the ash trees have been twice transplanted.

East of the roadway is a grove of catalpa, locust, ash, walnut and mulberry, planted in 1904. In the catalpa section of this grove a pruning experiment and a test of thickness of planting are being conducted.

The windbreak of pine, along the road from the picnic grounds to the orchards, was planted in 1895; the trees being from 2 to 3 feet in height at the time. The trees in the north part of this row are Scotch pine, and those in the south part are White pine.

North of the brick house is an arbor vitae screen set in 1895 with trees from 2 to 3 feet in height. Between the house and the barn is a screen of various kinds of trees set during the years 1895-1898.

The Station now has eight forest nursery plots. Three of these are located on the Wooster farms; one just south of the orchard barn; one south of the three-crop fertilizer test in the southeast corner of the farm, and the other just north of this test.

Because of a shortage of funds nothing has been done heretofore to improve the native woodlots here on the farm. Plans are now well advanced, however, to undertake this very important work next spring.

ANIMAL HUSBANDRY

B. E. CARMICHAEL, *Animal Husbandman*

N this department, the work consists of investigations concerning the production of milk and of meat. All of the dairy work and most of the feeding for beef are done at the central farm, although a few steers were fattened at the Germantown Test-Farm during the past winter. The work in sheep-feeding is being carried on at the Southeastern Test-Farm, near Carpenter, Meigs County.

The Station herd of cattle contains about 60 head, of various breeds and ages. At present, 15 cows are being used for dairy purposes. Various rations are compared for efficiency in milk production, and individual records are kept of food consumed and of milk and butter fat produced by each cow. A separator is in use, the cream being sold on the market, and the skim milk utilized in pig-feeding work.

Silage vs. grain for dairy cows

In beef production, work is being done with cattle raised on the Station farm and with feeding cattle from the Chicago market. The beef herd, which consists largely of Angus cattle, is divided in two groups, and in feeding these two groups, silage and dry feed are being compared for winter use, both for the maintenance of a beef breeding-herd and for the production of "baby beef." The beef-bred calves intended for market are grown rapidly from birth, the aim being to produce a desirable carcass at an early age. 63 head of steers, purchased in Chicago, are now on dry feed. In this work four different rations are being tested for efficiency in producing gains.

In a sheep feeding test, at the Carpenter Test-Farm a comparison is being made of native yearlings with yearlings from the western ranges. In this test are 194 head, and it will include a comparison of the grazing and fattening qualities of the two classes of sheep. During the past winter a lamb-feeding test, in which 160 lambs were used, was carried on in cooperation with Mr. S. J. Fryer, at his farm near Big Prairie. In the test, alfalfa, clover hay and corn proved to be a very satisfactory ration.

The work with hogs is, at present, very limited, but it is hoped that this phase of animal husbandry may be considerably enlarged. It is very probable that this work will be confined to the central farm and will consist of problems in feeding and breeding.

The Station live stock may be seen in the following places: aged dairy and beef herds, in dairy barn, in pastures adjoining, or in pastures across the road and east from the dairy barn; bred cows, not in milk, in woods pasture at east side of farm; young heifers of both beef and dairy breeds, in pasture southwest of feeding barn; "baby beef" steers, in dairy barn or in adjoining pastures; Holstein, Jersey, Angus, and Shorthorn bulls, at the dairy barn; feeding cattle from Chicago, in feeding barn; pigs, in lots north of dairy barn.

COOPERATIVE EXPERIMENTS

L. H. GODDARD, *Experimentalist*

Through this Department, any farmer in the state is enabled to try on his own farm almost any experiment, crop or crop method, that is being tried on the Station farms. Material for these tests is usually furnished the experimenter free of charge.

We aim to restrict the number of experimenters, as nearly as possible, to 1,000 each year, although so long as we have funds we are pleased to meet all requests. Every county in the state is well represented in our list of cooperators, and much work that is of value to science, as well as to the locality where tests are made, is being accomplished.

Detailed information regarding this work will be given upon request, or may be had from circular No. 47 of this Station.